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With the Author's

Compliments.

BORACIC ACID.
A NEW REMEDY
IN
EYE DISEASES.

BY

SAMUEL THEOBALD, M.D.,

*Surgeon to the Baltimore Charity Eye and Ear Dispensary;
Ophthalmic and Aural Surgeon to St. Vincent's
Hospital, Baltimore.*

*Reprinted from THE MEDICAL RECORD,
February 7, 1880.*

[WITH SUPPLEMENTARY NOTE.]

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BORACIC ACID—A NEW REMEDY IN EYE DISEASES.

It is with much pleasure I hasten to bring to the notice of the medical profession, and more especially to the attention of those engaged in ophthalmic practice, the astonishingly favorable results which I have recently obtained in the treatment of certain affections of the eyes, from the use of boracic acid, an agent which, so far as I am aware, has not been heretofore employed in ophthalmic diseases.

Boracic acid, which, until Lister brought it into notice as an antiseptic, was little used except in the manufacture of biborate of soda, is a mild astringent. A solution containing four grains of the acid to an ounce of water—which faintly reddens litmus-paper—when shaken in a test-tube with an equal quantity of the white of an egg, produces but a slight coagulation of the albumen; and even a saturated solution* acts much less energetically in this respect than does a one-grain solution of sulphate of zinc. Its antiseptic properties, according to Lister, are not so great as those of carbolic acid; nevertheless he recommends it in certain cases, because of its being less stimulating to the tissues.

In an article upon the “Antiseptic Treatment of

* At 73° F. an ounce of distilled water will dissolve twenty grains of the acid; in hot-water it is more freely soluble.

Suppuration of the Middle Ear," published in the *Archiv für Ohrenheilkunde*, Vol. XV., Part I., Bezold described the excellent results which he had obtained in this affection from finely powdered boracic acid, applied by insufflation to the external auditory meatus. An abstract of this paper, which appeared in the October number of the *American Journal of Otol-ogy*, came to my notice some weeks since, and induced me to experiment with the new remedy. The results which I obtained in a number of cases of otorrhœa were not less favorable than those which Bezold had reported; they led me, however, in one respect to a different conclusion. He placed but a poor estimate upon the efficacy of *solutions* of the acid, deeming it as essential that it should be used in *substance*; whereas, I obtained, in some cases at least, such very excellent results from solutions, varying in strength from five to ten grains to an ounce, as to induce me to place a higher estimate upon their value.

The prompt manner in which purulent discharges from the mucous membrane of the tympanal cavity were checked by these solutions, suggested the idea, that where similar discharges from the conjunctiva existed, equally good results might be obtained from their use as a collyrium. The first point to be ascertained, whether the eye would be unduly irritated by the application of the acid, was soon settled, and in a most satisfactory manner—a *four-grain solution when dropped into the eye was found to cause absolutely no irritation*. Even where a half-grain solution of sulphate of zinc gave rise to considerable smarting, the boracic acid induced not the slightest discomfort. A case of purulent ophthalmia, under my care at the

Baltimore Charity Eye and Ear Dispensary, afforded an excellent opportunity for further experimentation. When this case came under observation—the disease having been allowed for three weeks to run its course unchecked—a threatening corneal ulcer was present in each eye, while the purulent discharge was still as great as ever. Fearing, because of the condition of the corneæ, to use a stronger astringent solution, I had at first given a collyrium, to be applied four times a day, containing half a grain of nitrate of silver and one grain of atropia to an ounce of distilled water, which was well borne, but produced only slight diminution in the discharge. The proportion of nitrate of silver, therefore, was doubled; but in this strength, though it further checked the discharge, it caused so much irritation that I could use it but twice a day, alternating it with a one-grain solution of atropia.

Under this treatment the disease was slowly subsiding, the ulcers becoming less threatening, and the discharge less profuse; nevertheless at each visit I found it necessary to remove a great quantity of purulent secretion from the eyes, in order to obtain a view of the corneæ, and the palpebral conjunctiva was still swollen and villous.

It was at this stage, after three weeks' use of the nitrate of silver, that the boracic acid was employed. Giving a solution containing four grains of the acid and one of atropia to an ounce of distilled water, I directed it to be dropped into the left eye (in which the ulcer was more completely healed, though the discharge was not less profuse, than in the other) three times a day, in place of the nitrate of silver and atropia, which, however, were to be used as before to the right eye. This was on Monday. The case

was next seen on Wednesday, when, in response to my question as to how the eyes were getting on, the reply was: "One eye is a great deal better." And so it certainly was. To my great satisfaction the left eye was found to be entirely free from discharge; not a particle of pus, or even of mucus, could be discovered within the palpebral aperture, while the corneal ulcer was healing nicely, and the conjunctival swelling had greatly diminished. The other eye had changed but little, and still contained as much pus as before. The same treatment was now ordered for it. During the next two days, however, the patient—a wretched little specimen of illegitimacy, but half-nourished because of the illness of its mother—took a bad cold, which came near putting an end to its existence. The consequence was, that on the following Friday, although there was a decided diminution in the discharge from the right eye, the left was not so well, and contained a small amount of muco-purulent secretion. Nevertheless, in spite of this drawback, and an attack of thrush which next supervened as a consequence of improper feeding, the inflammation of the eyes rapidly declined under the influence of the acid, which caused not the slightest irritation; so that in three or four days the swelling of the lids and conjunctiva had entirely disappeared. At the expiration of a week, as a slight blennorrhœa still persisted, and the ulcers had so far healed as to give rise to no further anxiety, I ventured to increase the proportion of boracic acid in the collyrium, which was still being used three times a day, to eight grains to an ounce. This caused no irritation, but as a slight mucous secretion persisted after several days, it occurred to me to discontinue the atropia, which up to this time had

been combined with the acid. The change was immediately beneficial, and in twenty-four hours the secretion had nearly ceased. The case is still under observation, the drops as yet being used; but the subject of it, barring his eyes, is in so wretched a condition that I fear he will not live to enjoy the excellent vision which has been saved to him. Should, however, his fate be an early demise, he will, hereafter, doubtless derive additional enjoyment from a consciousness that his mundane existence, though brief, was not altogether in vain.

The next case in which I tried it was that of a boy, thirteen years old, the subject of inherited syphilis, who, while under treatment for an obstinate and severe sclero-keratitis of specific character, was attacked with a catarrhal conjunctivitis. After having satisfied myself that this was not produced by the atropia which was being used, I had tried in succession mild solutions of sulphate of zinc, alum, and nitrate of silver, but each with no appreciable benefit. The conjunctival inflammation seemed to be rendered peculiarly obstinate because of its association with the more serious corneal and sclerotic affection, so that, in spite of the various astringents which were employed, the catarrhal condition persisted, and I invariably found upon eversion of the lower lid an accumulation of mucus in the retro-tarsal fold.

After this treatment had been persevered in without effect for six weeks, a two-grain solution of boracic acid was given, to be dropped into the eyes three times a day. It caused no irritation whatever, and when, after two days' use of it, the eyes were examined, the catarrhal inflammation had disappeared, and I sought in vain for the usual accumu-

lation of mucus. Although it is now being used but twice a day (the case being still under observation), there has been no return of the conjunctivitis ; but, on the contrary, so rapid and decided an improvement in the sclero-corneal inflammation, which before had changed but little from week to week, as to convince me that upon this also it has exerted a decidedly beneficial influence.

After this I began with more confidence to make use of the new remedy. Even a saturated solution, when dropped into the eye, I found, although it gave rise to a constringent sensation analogous to that which alum produces in the mouth when tasted, caused only a very slight momentary smarting, accompanied by a trifling injection of the conjunctival vessels, which disappeared in two or three minutes. The two- and four-grain solutions not only occasioned no irritation, but when an irritation previously existed, produced a decidedly grateful sensation, which was described as soothing and cooling.

Among other cases in which I have since used it, the following may be briefly mentioned as illustrating its action, and as indicating the different conditions to which it seems applicable :

A patient, one of whose eyes I had enucleated four weeks previously, was much annoyed by an excessive secretion of mucus from the conjunctival sac as soon as he began to wear an artificial eye, and this in spite of his having used for some time before a four-grain solution of alum. A solution of boracic acid of the same strength was ordered to be instilled two or three times a day. He used it only twice a day, but in twenty-four hours the discharge was greatly diminished, and in two days was so far

checked as to give him no further inconvenience.

In two cases of myopia, complicated by astigmatism, in which, in spite of the use of correcting glasses, asthenopia persisted, accompanied occasionally by conjunctival hyperæmia, the acid is now being used with decided benefit—in one a four-grain, in the other a two-grain, solution, in order to compare their action. In each a one-grain solution of sulphate of zinc had previously been tried, and abandoned because of the irritation which it produced; while in one alum, acetate of zinc, bichlorate of soda, and acetate of lead, had likewise been used without benefit. The case in which the four-grain solution is being used is that of a young lady, seventeen years of age, who, as she is completing her last year at school, and is a hard student, has exacted of her eyes during the past three months an undue amount of day and night work, and, as a consequence, has suffered much with asthenopia attended by congestion of the lids and conjunctiva. Since using the acid, her eyes have looked and felt much better, and she expresses herself as greatly pleased with its action.

An acute conjunctivitis of catarrhal type, attended by an unusual amount of irritation, in a lady about forty years of age, in which a one-grain solution of sulphate of zinc had done more harm than good, yielded at once to a two-grain solution of boracic acid, each application of which lessened the irritability of the eyes, instead of increasing it, as the zinc had done. In a number of other cases of acute catarrhal conjunctivitis, I have obtained from it equally good results, while in a chronic conjunctivitis, associated

with nasal catarrh, it is being used with decided benefit.

In a case of kerato-conjunctivitis of scrofulous character in a little girl, attended by great photophobia and lachrymation, which did not yield to atropia and yellow oxide of mercury, I ventured to apply a two-grain solution of the acid, and finding it produced no smarting or irritation, I added one grain of atropia to it, and directed it to be used three times a day. It was well received, and decidedly lessened the conjunctival inflammation; but, on the fourth day, as the photophobia seemed rather greater, I gave in its stead a four-grain solution of atropia. After two days' use of this, the photophobia was somewhat lessened, but the conjunctival injection increased. A two-grain solution of the acid was then given, to be applied thrice daily, and to be followed by the atropia. In two days the redness had again disappeared, and in four days more the photophobia had gone, and the eye was free from inflammation.

In another case of scrofulous kerato-conjunctivitis, with a large phlyctenula upon the cornea, a solution of the same strength was used in connection with atropia for two days, without causing any irritation whatever, when, as the improvement was not satisfactory, yellow oxide of mercury ointment was substituted with advantage.

These two cases are of especial interest as showing how entirely free from irritating properties the acid is, for there is perhaps no condition in which the eye is so intolerant of astringents as in scrofulous keratitis, and had I used in either of these even a quarter-grain solution of nitrate of silver, or a half-grain solution

of sulphate of zinc, the consequences would in all probability have been decidedly unpleasant.

In a patient of strumous diathesis, under treatment for stricture of the nasal duct, a superficial keratitis of the affected eye, accompanied by conjunctival injection supervened, and proved of most obstinate character. Besides constitutional remedies, atropine, pilocarpine, belladonna and opium fomentations, and hot water, had each been tried in vain. Finally, an ointment of iodoform (gr. x. to vaseline, 3 j.) was tried, and under its influence and that of atropia a decided improvement set in; when suddenly, and probably as a result of the long-continued use of the atropia, a catarrhal conjunctivitis appeared. Fortunately, I had by this time learned the virtue of boracic acid, and so, discontinuing the other remedies, I ordered a two-grain solution of it, to be applied three times a day. In three days the conjunctivitis disappeared, and when I next saw my patient, at the end of a week, no redness remained, and the cornea was better than it had been for weeks.

A girl, seventeen years old, with extensive nebulous opacities in the cornea of the right eye, the remains of a severe scrofulous ophthalmia, reported at the dispensary a few days since, suffering from a recurrence of corneal and conjunctival inflammation. She had previously had several such relapses, and they had usually yielded, though slowly, to atropia and yellow oxide of mercury. In this instance I directed simply a two-grain solution of the acid to be applied three times a day, first, however, instilling a ten-grain solution, which produced no more smarting than as much water would have done. In two days she returned, with the inflammation entirely relieved.

How far the good effects of the boracic acid in the cases I have related were due to its antiseptic properties, and how far simply to its astringent action, I am not prepared to say, though I am disposed, since it is so feeble an astringent, to ascribe them, and more especially its influence over purulent and catarrhal conjunctivitis, in great part to the former. However this may be, I am confident that in the treatment of eye diseases, boracic acid has open to it a wide field of usefulness; and unless the results which I have obtained from it thus far prove to be exceptional, I believe it will, ere long, obtain a position in ophthalmic therapeutics second only to that of atropia. To those who are sufficiently familiar with this department of surgery to appreciate the immense advantage which will accrue from the possession of an agent capable of arresting purulent and muco-purulent discharges from the conjunctiva, and yet so bland in its action as to cause no irritation, even in phlyctenular keratitis, this prediction will not seem unreasonable.

The affections to which it seems especially adapted are: purulent conjunctivitis, including gonorrhœal ophthalmia, and ophthalmia neonatorum; catarrhal conjunctivitis; asthenopia from whatever cause arising, and the conjunctival hyperæmia which usually accompanies it; and, I think I may add, granular conjunctivitis, although it so happens that I have not yet had an opportunity of testing it in this condition. In phlyctenular ophthalmia, atropia and yellow oxide of mercury in most cases leave little else to be desired, but when the inflammation is chiefly conjunctival and somewhat catarrhal in type, these remedies do not always act so well, and in this condition

boracic acid will, I think, be found of service. In relieving atropinism, and when used with the atropia in preventing it, it is undoubtedly efficacious. In inflammatory affections of the cornea my experience of its action is as yet limited, but so far as it goes is *decidedly* favorable; and I would recommend its use in pannus, in ulcerative and suppurative keratitis, and in the various forms of diffuse corneal inflammation. As an adjunct to the probe in the treatment of lachrymal affections, it promises to be of much value. In marginal blepharitis, an ointment, containing ten grains of the acid to a drachm of simple cerate, has been of unmistakable service in some cases. And, finally, with boracic acid substituted for carbolic acid, the principles of antiseptic surgery may be applied to the graver operations upon the eye, with a prospect of better success than attended the recent experiments of Alfred Graefe in this direction.

As to the proper manner of employing the acid in the different conditions I have enumerated, much will have been gathered from what has gone before. In asthenopia, in catarrhal conjunctivitis, and in keratitis, I would recommend a solution containing from two to four grains to an ounce of distilled water, giving preference in most cases to the latter strength. As a rule, three or four times a day will be sufficiently often to apply it, but, if necessary, I believe it may be used more frequently with safety. In the different forms of purulent conjunctivitis, and more especially in gonorrhoeal ophthalmia, stronger solutions will probably be required; and since even a saturated solution (gr. xx. to ℥j.), as I have before stated, causes only the most trivial and momentary

irritation, I think it will be better, when the case can be kept under observation, not to trust to one of less strength.

It would be deemed, perhaps, an oversight, should I conclude this paper without alluding to the fact that for a long time baborate of soda has enjoyed an extensive reputation in eye diseases. It so happens that my experience with this salt has not been such as to induce me to place much confidence in its efficacy, and so I have seldom employed it, and, it may be, have underestimated its value. Such virtue as it possesses, I am now sure is derived from the boracic acid which enters into its composition, and which, through its union with soda, seems to lose in great part its efficiency.

Since the foregoing was written, I have had an opportunity of testing the acid in a second case of ophthalmia neonatorum, in two cases of chronic granular conjunctivitis with pannus, and in three cases of corneal inflammation of traumatic origin. In the first named, where there existed a profuse purulent discharge, a ten-grain solution was ordered to be dropped into each eye every three hours. In twenty-four hours there was an appreciable diminution in the discharge; in forty-eight it was greatly lessened, and had lost its purulent character; and to-day (this being the fourth since the treatment was commenced) the discharge is slight, the swelling of the lids and conjunctiva nearly gone, and the eyes are already out of danger. The child was six weeks old; the inflammation had begun about the ninth day, and had grown much worse during the few days preceding the inception of the treatment.

In the next two cases, I began with a four-grain

SUPPLEMENTARY NOTE.

A month has elapsed since this article was written, and the additional experience which I have gained from a very free use of boracic acid during this time, while it has convinced me that I have not overestimated its usefulness in eye diseases, has caused me to modify to some extent my views as to the manner in which it should be employed. Impressed with the fact that even strong solutions of the acid when applied to the most irritable eyes occasioned not the slightest discomfort or irritation, I at first fell into the mistake (as I have since learned it to be) of supposing that when solutions not exceeding four grains to an ounce were employed, they might under most circumstances be used with almost unlimited freedom. Further experience, however, has shown that when the acid is applied as often as I have recommended (three or four times a day), it is not always well borne for an indefinite length of time, but that after a longer or shorter period, varying in different cases from three or four days to as many weeks, it is liable to cause more or less irritation of the conjunctiva. This result has seemed to depend less upon the strength of the solution than upon the frequency of its application. In seeking to avoid it, therefore, I have been led to apply the acid less frequently than I previously did in similar cases, and, as it has not appeared that this in any degree lessened its good effect,* I have of late seldom ordered it to be used more than twice a day, even in acute cases, while in those in which it was proposed to employ it for a considerable length of time (such as granular conjunctivitis, pannus, obstinate keratitis, asthenopia, and the like), I have directed only a daily instillation, which by preference should be made in the morning. In purulent conjunctivitis it is especially well borne, and here, perhaps, more frequent applications (not oftener than three or four times a day, however) are indicated, at least until the inflammation shows signs of abating. As to the strength of the solution, I may say that I have not been able to convince myself that under any circumstances, even in purulent conjunctivitis, advantage was gained by exceeding four grains to an ounce. Perhaps, in the severer forms of this affection, the thorough application once a day of a saturated solution, by the surgeon, may be found productive of good results; but, with my present experience, I am not disposed to endorse what I have said as to the advisability of employing so strong a solution for frequent instillation.†

I have not yet been able to obtain chemically pure boracic acid. Perhaps there might be some advantage in using it; but as I have gotten especially favorable results from the acid made by Rosengarten & Sons, of Philadelphia, I have been led to use it exclusively, and would especially recommend it.

*One of the most brilliant results which I have yet obtained with it—the virtual cure in three days of a severe catarrhal conjunctivitis of four months' standing, in which sulphate of zinc, nitrate of silver and atropia had previously been used without effect by the family physician—was brought about by the application only twice a day of a two-grain solution, the only other treatment being the administration of tonic doses of tincture of iron and quinine.

†My friend Prof. Latimer, of this city, tells me that a few days since, in a case of ophthalmia neonatorum, he used a five-grain solution of the acid, applying it three times a day, and that in three days the case was cured and the treatment discontinued.

solution. In one this is still being used with decided benefit, in the other, in which an acute attack of corneal and conjunctival inflammation had set in, it had no effect, but a twenty-grain solution which has been instilled thrice daily for the past three days has been well received, and is certainly doing good.

In the last three, the effect of a four-grain solution has in each been surprisingly favorable. One of them, a stone cutter, while suffering from a catarrhal conjunctivitis, received a blow from a bit of stone upon the right cornea. After having used atropia for several days, his eye meantime getting worse, he came to me with a decided conjunctivitis, the lower half of the cornea quite misty, and a more opaque spot, with epithelium abraded, just below the centre of the cornea, marking the site of the wound. The atropia was discontinued and boracic acid only used. It produced a much pleasanter impression upon the eye than the atropia had done, and in two days the mistiness of the cornea and the conjunctivitis had disappeared.

It is evident that besides the astringent and antiseptic properties which boracic acid possesses, it exerts, when applied to the eye, a topical influence which may be properly termed sedative or anodyne.

6 CATHEDRAL ST., BALTIMORE, Jan. 16, 1880.

